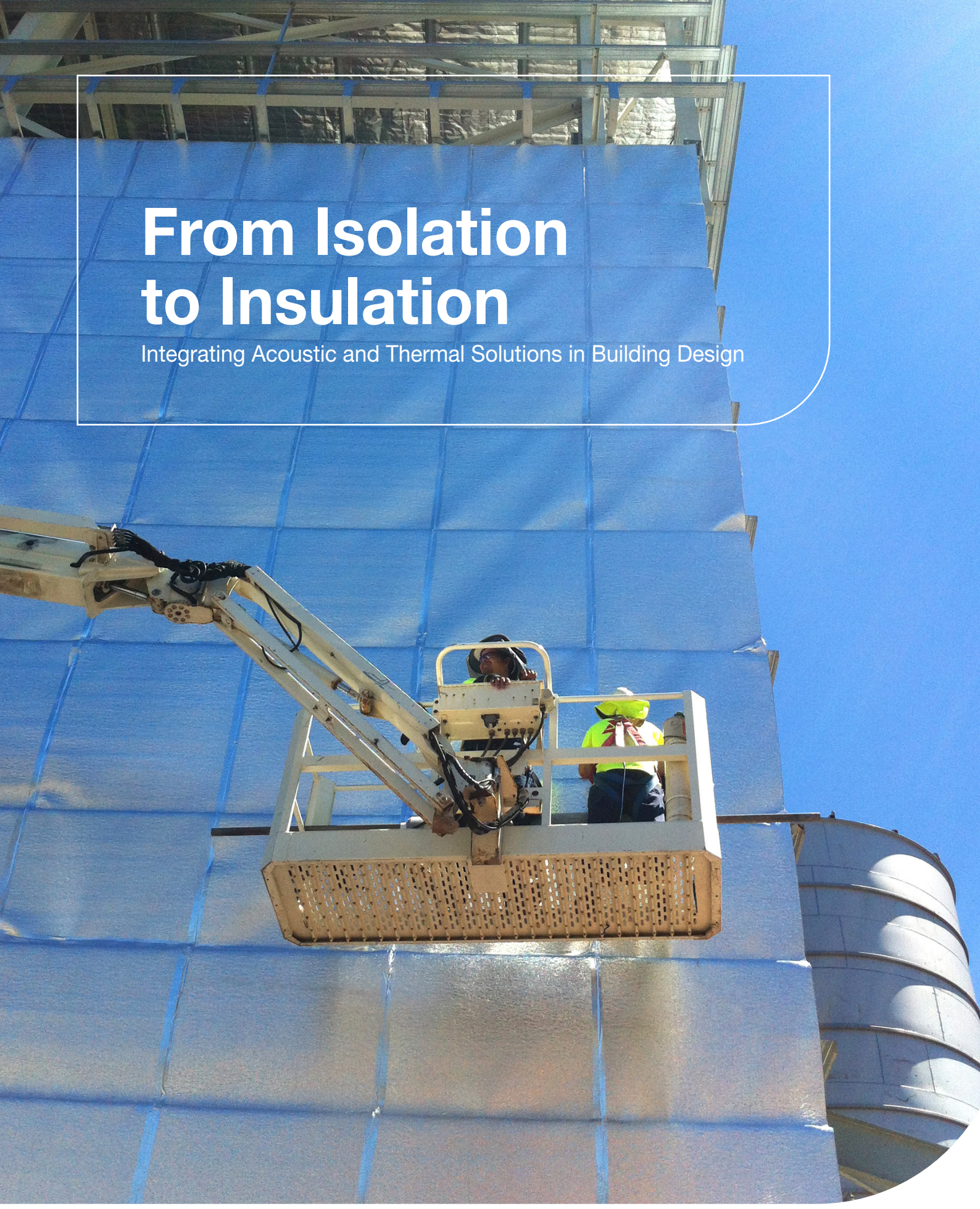
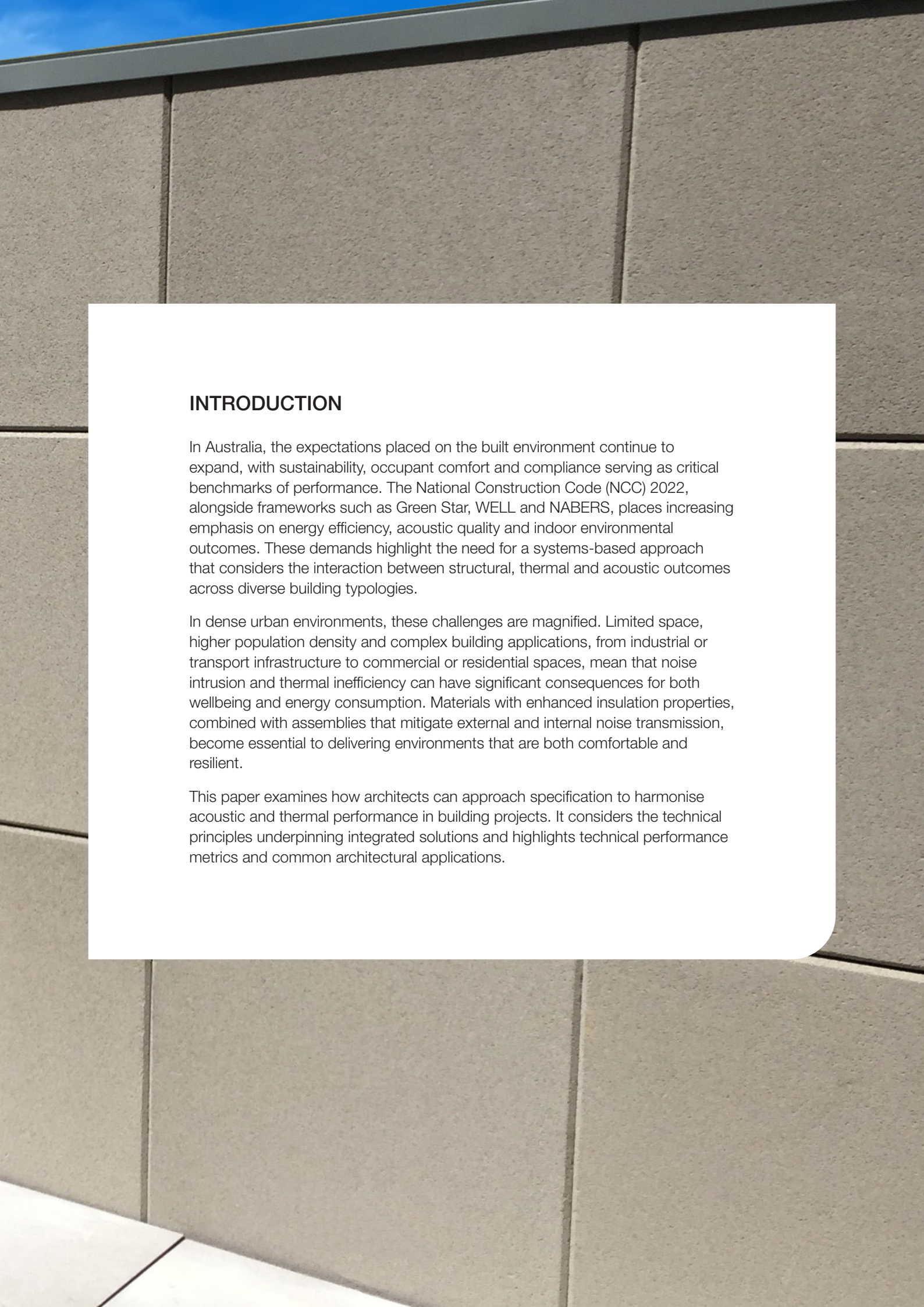


From Isolation to Insulation

Integrating Acoustic and Thermal Solutions in Building Design

Pyrotek®



INTRODUCTION

In Australia, the expectations placed on the built environment continue to expand, with sustainability, occupant comfort and compliance serving as critical benchmarks of performance. The National Construction Code (NCC) 2022, alongside frameworks such as Green Star, WELL and NABERS, places increasing emphasis on energy efficiency, acoustic quality and indoor environmental outcomes. These demands highlight the need for a systems-based approach that considers the interaction between structural, thermal and acoustic outcomes across diverse building typologies.

In dense urban environments, these challenges are magnified. Limited space, higher population density and complex building applications, from industrial or transport infrastructure to commercial or residential spaces, mean that noise intrusion and thermal inefficiency can have significant consequences for both wellbeing and energy consumption. Materials with enhanced insulation properties, combined with assemblies that mitigate external and internal noise transmission, become essential to delivering environments that are both comfortable and resilient.

This paper examines how architects can approach specification to harmonise acoustic and thermal performance in building projects. It considers the technical principles underpinning integrated solutions and highlights technical performance metrics and common architectural applications.

Relationship between acoustic and thermal performance in building design

Acoustic and thermal performance are closely related because both depend on how energy transfers through the building structure. Sound propagates as vibrations, while heat moves through conduction, convection and radiation, yet the strategies to control them often overlap. Materials that absorb, resist or redirect energy in one domain frequently deliver benefits in the other. For architects, recognising this connection is essential to making efficient specification decisions.

Traditional materials such as brick, concrete, and multi-layer plasterboard reduce sound transmission due to their high mass, but do little in terms of thermal insulation by themselves. While essential in design, they are often used in conjunction with other thermal insulation to achieve systems which excel in both acoustic and thermal performance. Modern systems increasingly achieve similar outcomes with reduced mass by using composite solutions, such as laminated gypsum boards, engineered panels or composite foams with added fillers, that combine stiffness, damping and insulation. These innovations allow architects to specify high-performance assemblies that meet acoustic and thermal targets while managing constraints around structural loading, cost and embodied carbon.

Mineral wool, glass wool and cellulose insulation absorb sound energy within their fibre matrices while entrapping air to reduce heat transfer. Similarly, high-performance composite foams, including phenolic and polyurethane foams engineered with acoustic skins or perforated facings, offer thermal insulation alongside targeted sound absorption.

In each case, performance ultimately depends on execution. Poorly detailed gaps, whether at service penetrations, junctions or perimeter edges, can act as weak points, enabling both sound flanking and convective heat loss. Even minor discontinuities reduce acoustic separation and lower effective R-values, diminishing the value of carefully specified materials. Continuity of insulation, proper separation and careful sealing are therefore essential to preserve both acoustic and thermal performance.

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Understanding performance metrics

Performance metrics give architects a structured way to assess how materials and assemblies perform. While acoustic and thermal performance metrics are applied independently, considering both during specification ensures that buildings deliver balanced performance rather than excelling in one area at the expense of the other.

Acoustic metrics

Weighted Sound Reduction Index (Rw): This rating measures how effectively a building element reduces airborne sound transmission. Rw is expressed in decibels (explained below). Higher Rw values indicate stronger separation between spaces and spectrum adaptation terms such as Ctr and C are often applied to reflect sensitivity to traffic noise or low-frequency sounds. For multi-residential and commercial projects, these values are critical in meeting the acoustic separation recommendations outlined in AS/NZS 2107.

Decibels (dB): A decibel is a logarithmic unit used to measure sound intensity or the reduction of sound through a material or assembly. It provides an objective, physical measure of sound across the full frequency spectrum. Note that dB(A) values are often used in environmental and occupational noise assessments. The “A” weighting modifies this measurement to account for how the human ear perceives sound.

Noise Reduction Coefficient (NRC): NRC indicates how much sound a material absorbs inside a room, expressed as a decimal between 0 and 1. Materials with higher NRC values (e.g., 0.80) absorb most incident sound energy, helping reduce reverberation and improve speech clarity. For architects, this metric informs the specification of ceiling tiles, wall panels and floor finishes to achieve comfortable interior acoustics.

Application of acoustic metrics in design: Rw and NRC address different but complementary aspects of acoustic performance. Rw relates to isolation, the ability of building elements to block sound transmission between spaces. For example, a wall with an Rw 50 dB rating reduces typical airborne noise, such as conversation or TV, from one apartment to the next by about 50 decibels under test conditions.

In another example, acoustic pipe lagging can lower breakout noise by about 25 dB(A). This means that the noise escaping from a service pipe, such as water flushing through a waste line, can be reduced to a level perceived by occupants as around one-quarter of its original loudness. In each case, high Rw ratings are only effective when paired with other design elements and careful detailing to avoid flanking paths through junctions, penetrations or continuous structures.

By contrast, NRC relates to absorption, addressing how sound behaves within a space rather than how it travels between spaces. Architects apply NRC values when designing interior environments where speech clarity, reverberation control or occupant comfort are priorities.

Thermal metrics

Thermal conductivity: This property describes how readily heat passes through a material. Lower conductivity values indicate better insulating performance, making it a key reference point for selecting insulation products.

R-value: R-value measures the overall resistance to heat flow, accounting for both the conductivity and thickness of materials. Higher R-values mean stronger insulation and reduced energy transfer.

U-value: The U-value is the reciprocal of the R-value and represents the overall rate of heat transfer through an assembly, including conduction, convection and radiation. Lower U-values signify higher efficiency and are particularly important for glazing, curtain walls and composite facade systems where multiple layers interact.

Application of thermal metrics in design: Architects apply these metrics during the specification and design process to ensure compliance with NCC Section J and to achieve targeted energy efficiency outcomes. Thermal conductivity guides the choice of insulation materials by indicating their relative performance per unit thickness. R-values and U-values are essential for evaluating building systems where heat transfer depends on multiple material layers. These values allow architects to compare systems, optimise facade design and balance thermal efficiency with daylighting and aesthetic goals.

Integrated acoustic and thermal solutions by Pyrotek

Delivering high-performance acoustic and thermal outcomes requires integrated systems that reduce redundancy, simplify construction and support compliance with the NCC and relevant Australian Standards. Pyrotek solutions exemplify this approach, offering products that address multiple performance domains while giving architects the flexibility to meet both regulatory and design objectives.

By combining acoustic isolation, absorption and thermal insulation in engineered assemblies, Pyrotek enables projects to achieve measurable improvements in efficiency, comfort and sustainability.

Reapor®

Reapor® demonstrates how acoustic absorption, durability and aesthetics can be combined in a single product. Manufactured from recycled glass granules, it delivers an exceptionally high **NRC of up to 0.95**, while being non-combustible, fibre-free and weather-resistant; ideal for both indoor and outdoor applications. Its stunning stone-like design, effective reverberation control and thermal stability makes it suited to infrastructure, healthcare and commercial projects. This product's performance is proven in projects such as:

- **Bayfair Shopping Centre (New Zealand):** Installed on the exterior wall to absorb traffic noise (panels have a high NRC of 0.95) while providing additional thermal properties and weather protection.
- **Sydney Metro Tunnel:** Applied to the tunnel's lower walls as a durable, non-combustible sound absorber to reduce noise and enhance fire safety.
- **Aldi store (Cobbitty, NSW):** Used to absorb and reduce rooftop plant noise, while withstanding withstand temperature fluctuations, high winds and other weather elements.

Soundlag®

Soundlag® is widely applied in commercial and residential buildings to control noise from hydraulic and wastewater pipes, ductwork and mechanical services. Its composite structure, with a dense vinyl barrier, decoupling layer and fire-resistant foil, delivers reductions of up to 25 dB(A) while also contributing to thermal insulation. Flexible and easy to install, Soundlag is frequently specified in multi-storey residential projects, hospitals and plant rooms where building services must remain quiet and efficient. Notable projects include:

- **Sunshine Coast University Hospital:** Installed around hospital pipework to provide acoustic insulation (reducing sound breakout by up to 25dB) and thermal control.
- **Barangaroo:** Applied to wastewater pipes to reduce airborne noise while meeting fire safety and building code requirements. The aluminium foil facing offers a fire resistant covering.

Quadzero™

Quadzero™, a foil-faced, mass-loaded vinyl barrier, delivers superior transmission loss with enhanced fire resistance. Engineered to be dense, flexible and tear-resistant, it limits noise transfer through walls, ceilings and floors. Its integrated reflective barrier removes the need for conventional insulating foils while improving the fire performance of the structure, making QZ a high-performance solution for domestic, commercial, industrial and OEM applications. QZ has been used in the following projects:

- **Melbourne Museum Gallery:** Used as an acoustic curtain to block noise from the adjoining children's gallery, preserving the quiet, contemplative atmosphere of the WWI exhibition.
- **ANZ Centre Docklands:** Installed in the ceiling plenums to block flanking noise between meeting rooms.

Together, these solutions reflect Pyrotek's commitment to integrated acoustic and thermal design. Whether applied in residential, commercial, healthcare, or infrastructure contexts, **Reapor®, Soundlag® and Quadzero™** enable architects to design for comfort, compliance and sustainability—achieving acoustic calm and thermal efficiency.

Delivering high-performance acoustic and thermal outcomes requires integrated systems that reduce redundancy, simplify construction and support compliance with the NCC and relevant Australian Standards.

Broader applications of Pyrotek acoustic and thermal solutions

Office buildings

In office buildings and commercial towers, Quadzero™ is widely used within inter-tenancy partitions and lightweight walls to improve Rw ratings and provide acoustic isolation between spaces. Within open-plan layouts, Reapor® panels can be applied to ceilings and walls to control reverberation while maintaining a modern, clean aesthetic. Combined with conventional thermal insulation in facades and roof systems, these treatments help buildings meet NCC Section J requirements while supporting a comfortable and productive indoor environment.

Residential

In apartments and townhouses, the NCC requires minimum Rw and impact isolation ratings for inter-tenancy systems. Quadzero™ enhances acoustic separation in walls, ceilings and floors, and is ideal for home theatres. Soundlag® effectively reduces plumbing and HVAC noise, ensuring quieter living spaces. Ceiling insulation also assists in reducing external noise from rain, aircraft and traffic while contributing to thermal control.

Hospitality

Cafés, bars and restaurants require acoustic control for speech intelligibility and thermal stability. In addition to outdoor spaces, Reapor® is ideal for lining interior walls and ceilings, delivering high NRC values to reduce reverberation without compromising décor. Where service equipment or ductwork generates disruptive noise, Soundlag® is applied to wrap pipes and ducts, controlling breakout sound while adding thermal insulation to reduce energy losses. These integrated treatments improve the patron experience and help operators manage HVAC efficiency.

Education

Schools and universities demand solutions that enhance both concentration and comfort. Reapor® provides highly absorptive finishes for classrooms, lecture halls and libraries, helping achieve the reverberation control recommended under AS/NZS 2107. For mechanical services, Soundlag® ensures ductwork and plumbing operate quietly, preventing noise from disrupting learning. Together with standard insulation systems, these products create learning environments that are quiet, thermally stable and compliant.

Hospitals and aged-care

Healthcare environments require acoustic calm and thermal stability to support recovery and wellbeing. Reapor® provides non-combustible, fibre-free absorption for walls and ceilings in wards and waiting areas, while also being suited to high-traffic areas such as hospital carparks where durability and fire safety are critical. Soundlag® addresses plant and plumbing noise, reducing mechanical disruption in sensitive zones, while Quadzero™ enhances partition walls for privacy and fire safety compliance.

Sports and leisure centres

Large halls and gyms amplify sound and suffer high thermal loads. Reapor® panels are effective in controlling reverberation across large volumes. Insulated assemblies incorporating these treatments reduce HVAC demand, improving comfort, usability and energy efficiency in high-activity environments.

Transport hubs and tunnels

Transport hubs and tunnels demand solutions for low-frequency noise, heat and durability. Reapor® absorbs echo on concourse linings, vent shafts and tunnel walls, Decidamp® RTD dampens track resonance to cut noise and maintenance, and Viterolite® 900 provides non-combustible, impact-resistant absorption in high-traffic areas. Combined, they deliver turnkey acoustic solutions for large-scale infrastructure.

Major projects and construction sites

Large-scale worksites generate high levels of temporary noise requiring robust yet flexible solutions. Wavebar® and Wavebar® NC, Pyrotek's original mass-loaded vinyl barrier, can serve as temporary barriers or curtains to reduce noise from drilling, tunnelling or heavy equipment.

For more information on the complete Pyrotek range of thermal and acoustic solutions, go to https://www.pyroteknc.com

All information provided correct as of October 2025